

1   **SECTION 6-14, GEOSYNTHETIC RETAINING WALLS**

2   **April 5, 2004**

3   **6-14.1 Description**

4   This work consists of constructing geosynthetic retaining walls, including those shown in the  
5   Standard Plans.

7   **6-14.2 Materials**

8   Materials shall meet the requirements of the following sections:

9

10       Gravel Borrow For Geosynthetic Retaining Wall	9-03.14(4)
11       Construction Geosynthetic	9-33

12

13   The requirements specified in Section 2-12.2 for geotextiles shall also apply to geosynthetic  
14   and geogrid materials used for permanent and temporary geosynthetic retaining walls.

15  
16   Other materials required shall be as specified in the Special Provisions.

17  
18   **6-14.3 Construction Requirements**

19   Temporary geosynthetic retaining walls are defined as those walls and wall components  
20   constructed and removed or abandoned before the physical completion date of the project or  
21   as shown in the Plans. All other geosynthetic retaining walls shall be considered as  
22   permanent.

23  
24   **6-14.3(1) Quality Assurance**

25   The Contractor shall complete the base of the retaining wall excavation to within plus or  
26   minus three inches of the staked elevations unless otherwise directed by the Engineer. The  
27   Contractor shall place the external wall dimensions to within plus or minus two inches of that  
28   staked on the ground. The Contractor shall space the reinforcement layers vertically and  
29   place the overlaps to within plus or minus one inch of that shown in the Plans.

30  
31   The completed wall(s) shall meet the following tolerances:

32

33	<u>Permanent Wall</u>	<u>Temporary Wall</u>
34		
35       Deviation from the design		
36       batter and horizontal alignment		
37       for the face when measured		
38       along a ten foot straight edge at		
39       the midpoint of each wall layer		
40       shall not exceed:	3 inches	5 inches
41		
42       Deviation from the overall		
43       design batter per ten feet of wall		
44       height shall not exceed:	2 inches	3 inches
45		
46       Maximum outward bulge of		
47       the face between backfill		
48       reinforcement layers shall		
49       not exceed:	4 inches	6 inches

50

1     **6-14.3(2) Submittals**

2     A minimum of 14 calendar days prior to beginning construction of each wall the Contractor  
3     shall submit detailed plans for each wall in accordance with Section 6-01.9. As a minimum,  
4     the submittals shall include the following:

- 5
- 6         1. Detailed wall plans showing the actual lengths proposed for the geosynthetic  
7             reinforcing layers and the locations of each geosynthetic product proposed for use  
8             in each of the geosynthetic reinforcing layers.
  - 9
  - 10        2. The Contractor's proposed wall construction method, including proposed forming  
11            systems, types of equipment to be used and proposed erection sequence.
  - 12
  - 13        3. Manufacturer's Certificate of Compliance, samples of the retaining wall  
14            geosynthetic and sewn seams for the purpose of acceptance as specified.
  - 15
  - 16        4. Details of geosynthetic retaining wall corner construction, including details of the  
17            positive connection between the wall sections on both sides of the corner.
  - 18
  - 19        5. Details of terminating a top layer of retaining wall geosynthetic and backfill due to a  
20            changing retaining wall profile.
  - 21

22     Approval of the Contractor's proposed wall construction details and methods shall not relieve  
23     the Contractor of their responsibility to construct the walls in accordance with the  
24     requirements of these Specifications.

25

26     **6-14.3(3) Excavation and Foundation Preparation**

27     Excavation shall conform to Section 2-09.3(4), and to the limits and construction stages  
28     shown in the Plans. Foundations soils found to be unsuitable shall be removed and  
29     replaced in accordance with Section 2-09.3(1)C.

30

31     The Contractor shall direct all surface runoff from adjacent areas away from the retaining  
32     wall construction site.

33

34     **6-14.3(4) Erection and Backfill**

35     The Contractor shall begin wall construction at the lowest portion of the excavation and shall  
36     place each layer horizontally as shown in the Plans. The Contractor shall complete each  
37     layer entirely before beginning the next layer.

38

39     Geotextile splices shall consist of a sewn seam or a minimum 1'-0" overlap. Geogrid splices  
40     shall consist of adjacent geogrid strips butted together and fastened using hog rings, or  
41     other methods approved by the Engineer, in such a manner to prevent the splices from  
42     separating during geogrid installation and backfilling. Splices exposed at the wall face shall  
43     prevent loss of backfill material through the face. The splicing material exposed at the wall  
44     face shall be as durable and strong as the material to which the splices are tied. The  
45     Contractor shall offset geosynthetic splices in one layer from those in the other layers such  
46     that the splices shall not line up vertically. Splices parallel to the wall face will not be  
47     allowed, as shown in the Plans.

48

49     The Contractor shall stretch out the geosynthetic in the direction perpendicular to the wall  
50     face to ensure that no slack or wrinkles exist in the geosynthetic prior to backfilling.

1 For geogrids, the length of the reinforcement required as shown in the Plans shall be defined  
2 as the distance between the geosynthetic wrapped face and the last geogrid node at the end  
3 of the reinforcement in the wall backfill.  
4

5 The Contractor shall place fill material on the geosynthetic in lifts such that six inches  
6 minimum of fill material is between the vehicle or equipment tires or tracks and the  
7 geosynthetic at all times. The Contractor shall remove all particles within the backfill  
8 material greater than three inches in size. Turning of vehicles on the first lift above the  
9 geosynthetic will not be permitted. The Contractor shall not end dump fill material directly on  
10 the geosynthetic without the prior approval of the Engineer.  
11

12 Should the geosynthetic be damaged or the splices disturbed, the backfill around the  
13 damaged or displaced area shall be removed and the damaged strip of geosynthetic  
14 replaced by the Contractor at no expense to the Contracting Agency.  
15

16 The Contractor shall use a temporary form system to prevent sagging of the geosynthetic  
17 facing elements during construction. A typical example of a temporary form system and  
18 sequence of wall construction required when using this form are detailed in the Plans. Soil  
19 piles or the geosynthetic manufacturer's recommended method, in combination with the  
20 forming system shall be used to hold the geosynthetic in place until the specified cover  
21 material is placed.  
22

23 The Contractor shall place and compact the wall backfill in accordance with the wall  
24 construction sequence detailed in the Plans and Method C of Section 2-03.3(14)D, except  
25 as follows:  
26

- 27 1. The maximum lift thickness after compaction shall not exceed ten inches  
28
- 29 2. The Contractor shall decrease this lift thickness, if necessary, to obtain the  
30 specified density.  
31
- 32 3. Rollers shall have sufficient capacity to achieve compaction without causing  
33 distortion to the face of the wall in accordance with Section 6-14.3(1).  
34
- 35 4. The Contractor shall not use sheepfoot rollers or rollers with protrusions.  
36
- 37 5. The Contractor shall compact the zone within three feet of the back of the wall  
38 facing panels without causing damage to or distortion of the wall facing elements  
39 (welded wire mats, backing mats, construction geotextile for wall facing, precast  
40 concrete facing panels, and concrete blocks) by using light mechanical tampers as  
41 approved by the Engineer. No soil density tests will be taken within this area.  
42
- 43 6. For wall systems with geosynthetic reinforcement, the minimum compacted backfill  
44 lift thickness of the first lift above each geosynthetic reinforcement layer shall be six  
45 inches.  
46

47 The Contractor shall construct wall corners at the locations shown in the Plans, and in  
48 accordance with the wall corner construction sequence and method submitted by the  
49 Contractor and approved by the Engineer. Wall angle points with an interior angle of less  
50 than 150 degrees shall be considered to be a wall corner. The wall corner shall provide a  
51 positive connection between the sections of the wall on each side of the corner such that the  
52 wall backfill material cannot spill out through the corner at any time during the design life of

1 the wall. The Contractor shall construct the wall corner such that the wall sections on both  
2 sides of the corner attain the full geosynthetic layer embedment lengths shown in the Plans.

3  
4 Where required by retaining wall profile grade, the Contractor shall terminate top layers of  
5 retaining wall geosynthetic and backfill in accordance with the method submitted by the  
6 Contractor and approved by the Engineer. The end of each layer at the top of the wall shall  
7 be constructed in a manner which prevents wall backfill material from spilling out the face of  
8 the wall throughout the life of the wall. If the profile of the top of the wall changes at a rate of  
9 1:1 or steeper, this change in top of wall profile shall be considered to be a corner.

#### 10 11 **6-14.3(5) Guardrail Placement**

12 The Contractor shall install guardrail posts as shown in the Plans after completing the wall,  
13 but before the permanent facing is installed. The Contractor shall install the posts in a  
14 manner that prevents bulging of the wall face and prevents ripping, tearing, or pulling of the  
15 geosynthetic reinforcement. Holes through the geosynthetic reinforcement shall be the  
16 minimum size necessary for the post. The Contractor shall demonstrate to the Engineer  
17 prior to beginning guardrail post installation that the installation method will not rip, tear, or  
18 pull the geosynthetic reinforcement.

#### 19 20 **6-14.3(6) Permanent Facing**

21 The Contractor shall apply a permanent facing to the surface of all permanent geosynthetic  
22 retaining walls as shown in the Plans. Shotcrete facing, if shown in the Plans, shall conform  
23 to Section 6-18. Concrete fascia panel, if shown in the Plans, shall conform to Section 6-  
24 15.3(9).

#### 25 26 **6-14.3(7) Geosynthetic Retaining Wall Traffic Barrier and Geosynthetic** 27 **Retaining Wall Pedestrian Barrier**

28 Geosynthetic retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier, if  
29 shown in the Plans, shall be constructed in accordance with Sections 6-02.3(11)A and 6-  
30 10.3(2), and the details in the Plans, except as follows:

- 31
- 32 1. The slip-form method of barrier construction will not be allowed for geosynthetic  
33 retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier.
  - 34
  - 35 2. The Contractor shall not begin placing backfill above the bottom of the geosynthetic  
36 retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier until  
37 removing the forms from the portion of the barrier being embedded. The  
38 Contractor shall not remove forms from the embedded portion of the barrier until  
39 the concrete has set for at least three days or has attained a minimum compressive  
40 strength of 2,400 psi.
  - 41

#### 42 **6-14.4 Measurement**

43 Permanent geosynthetic retaining wall and temporary geosynthetic retaining wall will be  
44 measured by the square foot of face of completed wall.

45  
46 Gravel borrow for geosynthetic retaining wall backfill will be measured as specified in  
47 Section 2-03.4.

48  
49 Shotcrete facing and concrete fascia panel will be measured by the square foot surface area  
50 of the completed facing or fascia panel, measured to the neat lines of the facing or panel as  
51 shown in the Plans.

52

Geosynthetic retaining wall traffic barrier and geosynthetic retaining wall pedestrian barrier will be measured as specified in Section 6-10.4 for cast-in-place concrete barrier.

#### **6-14.5 Payment**

Payment will be made in accordance with Section 1-04.1 for each of the following bid items when they are included in the proposal:

"Geosynthetic Retaining Wall", per square foot.

"Temporary Geosynthetic Retaining Wall", per square foot.

All costs in connection with constructing the temporary or permanent geosynthetic retaining wall as specified shall be included in the unit contract price per square foot for "Geosynthetic Retaining Wall" and "Temporary Geosynthetic Retaining Wall", including compaction of the backfill material and furnishing and installing the temporary forming system.

"Borrow for Geosynthetic Wall Incl. Haul", per ton or per cubic yard.

All costs in connection with furnishing and placing backfill material for temporary or permanent geosynthetic retaining walls as specified shall be included in the unit contract price per ton or per cubic yard for "Gravel Borrow for Geosynthetic Wall Incl. Haul".

"Concrete Fascia Panel", per square foot.

All costs in connection with constructing the concrete fascia panels as specified shall be included in the unit contract price per square foot for "Concrete Fascia Panel", including all steel reinforcing bars, premolded joint filler, polyethylene bond breaker strip, joint sealant, pvc pipe for weep holes, exterior surface finish, and pigmented sealer (when specified).

Shotcrete facing will be paid for in accordance with Section 6-18.5.

"Geosynthetic Retaining Wall Traffic Barrier", per linear foot.

"Geosynthetic Retaining Wall Pedestrian Barrier", per linear foot.

The unit contract price per linear foot for "Geosynthetic Retaining Wall \_\_\_\_ Barrier" shall be full pay for constructing the barrier on top of the geosynthetic retaining wall.